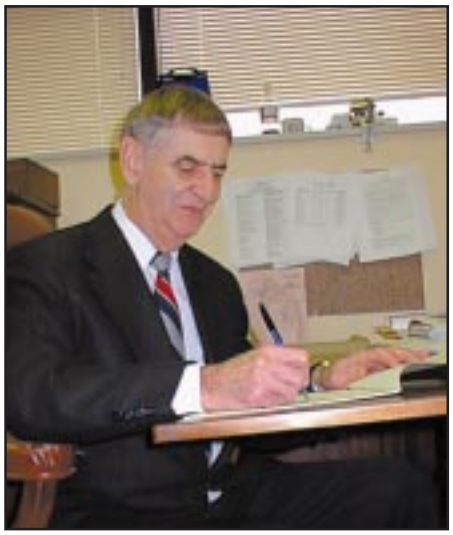
Dr. Pagano Earns Air Force Basic Research Award "Honorable Mention"



Payoff

Dr. Nicholas J. Pagano's selection for an Air Force Basic Research Award "Honorable Mention" recognizes his work in micro-mechanics and his central role in the development and application of the Axisymmetric Damage Model (ADM). Engineers use ADM to characterize damage incurred by various types of composite materials and provide a clearer understanding to the field of interface characterization and the model's simplified equations.

Accomplishment

Dr. Pagano, a materials scientist with the Materials and Manufacturing Directorate's Nonmetallic Materials Division, has earned an Air Force Basic Research Award "Honorable Mention" for outstanding contributions in composite materials research. Dr. Pagano was recognized for his work in micro-mechanics and his central role in the development and application of ADM. This research could pave the way for the introduction of rigorous failure criteria and development of consistent lamination theories for aircraft composites and space applications. As a result, multitudes of design and material concepts and options could be achieved through calculation and computer simulation in a safe, very efficient, cost-effective process. These efforts could result in millions of dollars in savings to the Air Force, the Department of Defense, and the commercial aerospace industry.

Background

Today's composite structure designs are based on a heavily empirical approach requiring millions of dollars to perform qualification testing on just a single composite material system. Despite this extensive testing, there are still too many material and geometric variables in composites to allow for adequate characterization. As a result, structures are not optimized and can be overweight in some cases or even unsafe. Dr. Pagano was named a recipient of an Air Force Basic Research Award "Honorable Mention" for his research in micro-mechanics and development of the ADM used to characterize damage incurred by various types of composite materials. An important application of the model deals with the concept of steady state cracking, which was introduced about 20 years ago, but was not calculated accurately until the present work in which a rigorous three-dimensional, path-independent contour integral was derived and implemented. The accurate modeling of ply-level damage, such as transverse cracks in off-axis layers and delamination between adjacent layers of different fiber orientation, is of primary importance in predicting the failure of composite laminated structures. Transverse cracks often result in loss of strength and stiffness, and changes in the coefficient of thermal expansion. These cracks also provide pathways for moisture and other corrosive agents and are a precursor of the fatigue process. The existing numerical methods, such as finite element and boundary element methods, are limited in their ability to accurately model generalized mixed boundary value problems for composite laminates containing damage. The ADM could lead to rigorous failure criteria and development of consistent lamination theories for aircraft and space vehicles. Dr. Pagano has published five professional papers on the ADM.